Photobiomodulation enhances the Th1 immune response of human monocytes

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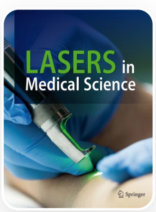

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Abstract

This study aims to evaluate the effects of photobiomodulation (PBM) on human monocytes, assessing the oxidative burst and ultimate fungicidal potential of these cells, as well as the gene expression at the mRNA level of CD68, CD80, CD163, CD204, IL-6, TNF-α and IL-10 in derived macrophages. Primary cultures of human monocytes were irradiated with an InGaAlP (660 nm)/GaAlAs (780 nm) diode laser (parameters: 40 mW, 0.04 cm^2, 1 W/cm^2; doses: 200, 400 and 600 J/cm^2). Cells were submitted to the chemiluminescence assay, and a microbicidal activity assay against *Candida albicans* was performed. Reactive oxygen species (ROS) and nitric oxide (NO) production were measured, and cell viability was assessed by the exclusion method using 0.2% Trypan blue reagent. Irradiated monocytes were cultured for 72 h towards differentiation into macrophages. Total RNA was extracted, submitted to reverse transcription and real-time PCR. The results were analysed by ANOVA and the Tukey test ($\alpha = 0.05$). Irradiated monocytes revealed a significant increase in their intracellular and extracellular ROS ($P < 0.001$). The 660 nm wavelength and 400 J/cm^2 dose were the most relevant parameters ($P < 0.001$). The fungicidal capacity of the monocytes was shown to be greatly increased after PBM ($P < 0.001$). PBM increased the expression of TNF-α ($P = 0.0302$) and the production of NO ($P < 0.05$) and did not impair monocyte viability. PBM induces a pro-inflammatory Th1-driven response in monocytes and macrophages.

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Ethics declarations

Conflict of interest

The authors declare that they have no conflict of interest.

Ethical approval

The present study was approved by the Human Research Ethics Committee of the University Federal of Alfenas, Brazil (Protocol # 1980248).

Informed consent

Informed consent was obtained from all individual participants included in the study.

Additional information

Publisher's note

Supplementary information

Fig. S1

The process of differentiating monocytes into macrophages was followed for 72 h, observing the change in the morphological aspect of the cells. Monocytes (arrow) have a rounded morphology, whilst macrophages (star) cease to be rounded cells and become elongated, spindle shaped and often stellar. Image obtained by inverted microscopy in phase contrast (× 400). (PNG 772 kb)

High resolution (TIF 1332 kb)

Table S1

(DOCX 36 kb)

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